1.6 Classification of Computers

1) Classification on the basis of working principle/application:

On the basis of working principle or application, we can categorize computers into 3 types:

a) Analog Computers

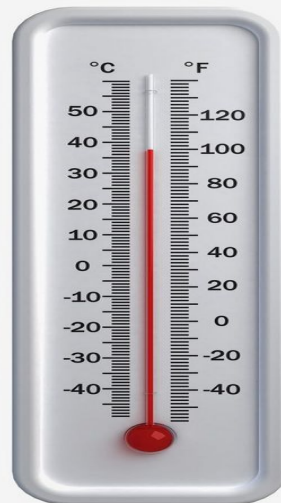b) Digital Computers

c) Hybrid Computers

a) Analog Computers:

- An analog computer is a form of computer that uses continuous physical phenomena such as electrical,mechanical or hydraulic quantities to model the problem being solved.

- Examples: Thermometers,Speedometers,etc.

Characteristics of Analog Computers:

- They are based on continuously varying data.

- These computers measures only natural or physical values.

- They are used for special purpose.

- Generally, no storage facility is available. If provided,only little amount of storage is available in it.

- Accuracy of these computers is very low.

- These computers are faster than digital computers.

Analog Computers

Prepared By Er. Sharat Maharjan

b) Digital Computers:

- A computer that performs calculations & logical operations with quantities represented as digits,usually in the binary number system(0s & 1s) is called digital computer.

- The meaning of 0 is OFF & 1 is ON.

- Examples: Desktop, Digital watches, Calculators,etc

Characteristics of Digital Computers:

- They are based on discrete data (1,0).

- They are normally used for general purpose.

- They are more reliable & accurate.

- They have large storage capacity.

- They are programmable.

- They are slower than analog computers.

Digital Computers

Prepared By Er. Sharat Maharjan

c) Hybrid Computers:

- A hybrid computer is a type of computer that offers the functionalities of both a digital and an analog computer..

- Examples: Devices used in petrol pumps,devices used in the hospitals to measure the heartbeat of patient, digital speedometer, etc.

Characteristics of Hybrid Computers:

- They combine of good qualities of analog as well as digital computers.

- They can process both continuous & digital data.

- They have capacity to convert analog data into digital data & vice-versa.

- Normally, these are special purpose machines.

- They normally have high cost.

Hybrid Computers

Prepared By Er. Sharat Maharjan

2) Classification on the basis of Power & Size:

On the basis of power & size, we can categorize digital computers into 4 categories:

a) Super Computers

b) Mainframe Computers

c) Mini Computers

d) Micro Computers

a) Super Computers:

- They are one of the fastest computers currently available which are used in scientific research.

- They are very expensive & are employed for specialized applications that require immense amount of mathematical calculations.

- They consist of thousands of integrated microprocessors for parallel processing.

- For example, weather forecasting, scientific simulations, cryptanalysis, graphics & animations,etc

- Examples: Cray-1, ETA10, Y-MP/C90,etc.

b) Mainframe Computers:

- They are very large in size & are expensive computers capable of supporting hundreds or even thousands of users simultaneously.

- They are used as large servers.

- They execute many programs concurrently.

- Large organizations rely on these computers to handle large programs with lots of data.

- Mainly used by banks, airlines, ticket reservation system,etc.

- Examples: IBM360,IBM z13,etc.
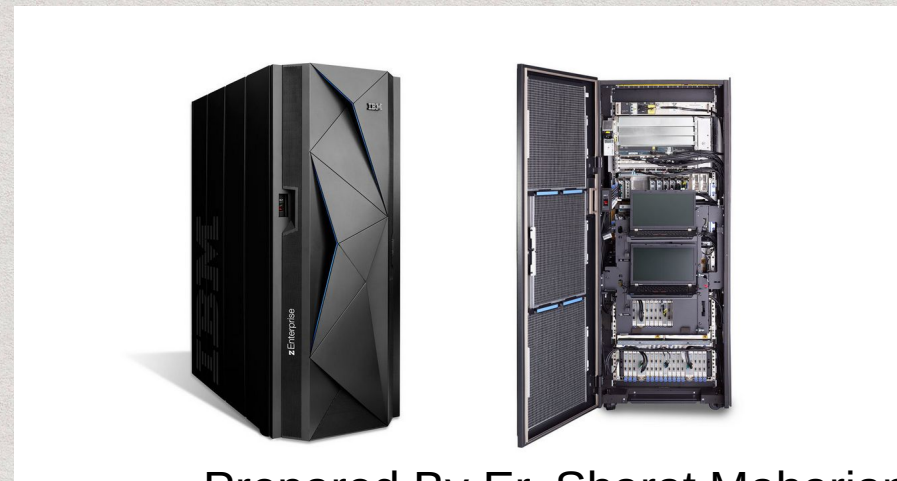
c) Mini Computers:

- They are mid-sized multi-processing computers capable of supporting tens to hundreds users simultaneously.

- Mainly used in managing the information in a small financial system or maintaining a small database of information about registrations or applications.

d) Micro Computers:

- They are smaller, cheaper & less powerful than mini computers or other computers.

- They are designed to handle single user.

- These computers are microprocessor based computers & hence named as micro-computer.

- Mainly used for personal, office, education,etc.

- Examples: Desktop Computers, Laptops,etc.

3) Classification on the Basis of Brand:

On the basis of brand,we can categorize computers as:

a) IBM PC

b) IBM Compatibles

c) Apple/Macintosh Computer

a) IBM PC:

- It stands for International Business Machine Personal Computer & developed by IBM company.

- IBM company is the first company that manufactured personal computers which uses CISC(Complex Instruction Set Computing) CPUs.

- It uses Intel chips & relied to Microsoft for operating system.

- They are expensive & powerful computers than IBM compatibles.

b) IBM Compatible Computers:

- Many manufacturers started making their own IBM Compatible computers by designing BIOS of their own which could be used with IBM computers.

- These computers are cheaper than IBM.

- They are made for general people.

- These computers can support all the software of IBM.

c) Apple/Macintosh Computers:

- All the computers manufactured by Apple Co-operation are known as Apple/Macintosh computers.

- These computers use their own software & hardware & are totally different than that of IBM computers.

- They provide better quality of graphic output.

- It featured a graphical interface & the mouse.

1.7 Mobile Computing

- Mobile computing is a technology that allows transmission of data, voice & video via a computer or any other wireless enabled device without having to be connected to a fixed physical link.

- The signals are carried over the air to intended devices that are capable of receiving & sending similar kinds of signals.

- Smartphone technology is a part of mobile computing.

- Mobile computing is a distributed system which is connected via a wireless network for communication.

- A mobile computing system consists of following components:
    a) Mobile hardware
    b) Mobile software
    c) Mobile communication

a) Mobile hardware:

- It is a small & portable computing device with the ability to retrieve & process data.

- Mobile computing devices have the hardware & software required to execute typical desktop & web applications.

- These devices have an Operating System(OS) embedded in them & able to run applications software on top of it.

- These devices are equipped with sensors, full-duplex data transmission & have the ability to operate on wireless networks such as WiFi & Bluetooth.

b) Mobile software:

- It is the software program that runs on mobile hardware.

- This is usually the OS in mobile devices.

- These OSs provide features such as touch screen, cellular connectivity, WiFi, bluetooth, GPS, camera,etc.

c) Mobile communication:

- It is the exchange of data & voice using existing wireless networks.

- The wireless networks utilized in communication are infrared, bluetooth, W-LANs, cellular data networks & satellite communication system.

Advantages of Mobile Computing:

a) Increase in Productivity: Mobile devices can be used in the field of various companies reducing the time & cost for clients & themselves.

b) Entertainment: Mobile devices can be used for entertainment purposes, for personal & even for presentations to people & clients.

c) Portability: This is the main advantage of mobile computing since we are not restricted to one location in order to get jobs done.

d) Cloud computing: This service is available for saving documents on an online server & being able to access them anytime & anywhere when one has a connection to the internet.

Disadvantages:

a) Quality of connectivity: Mobile devices will need either Wi-Fi connectivity or mobile network connectivity for communication.

b) Security concerns: Accessing a Wi-Fi network can be risky since WPA & WEP security can be bypassed easily.

Prepared By Er. Sharat Maharjan

1.8 Computer Architecture:

- Computer architecture is a set of rules and methods that describe the functionality, organization, and implementation of computer systems.

- There are basically two types of digital computer architectures:

a) Von Neumann Architecture:

- According to this architecture, computers have single memory that stores both programs & data.

- In this architecture, an instruction fetch & a data fetch cannot occur at the same time because they share a common bus.
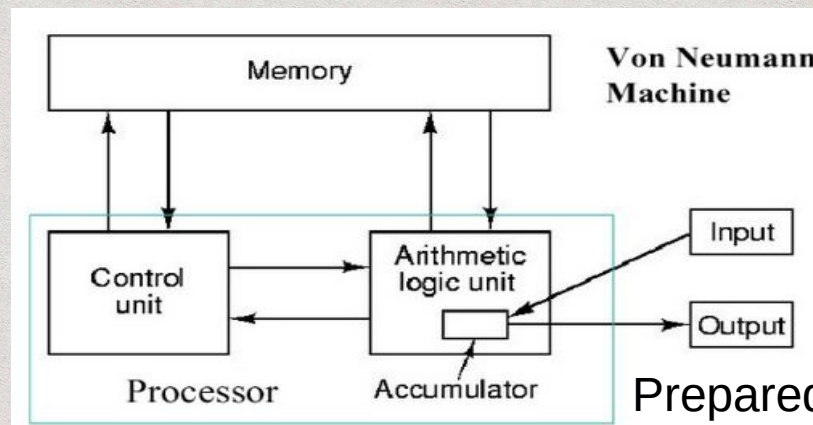
b) Harvard Architecture:

- According to this architecture, computers have two separate memories for storing programs & data.

- In this architecture, it is possible to access program memory & data memory simultaneously.

- Most of the modern computer architecture are based on Harvard architecture.

- Typically, program memory is read-only & data memory is read-write.
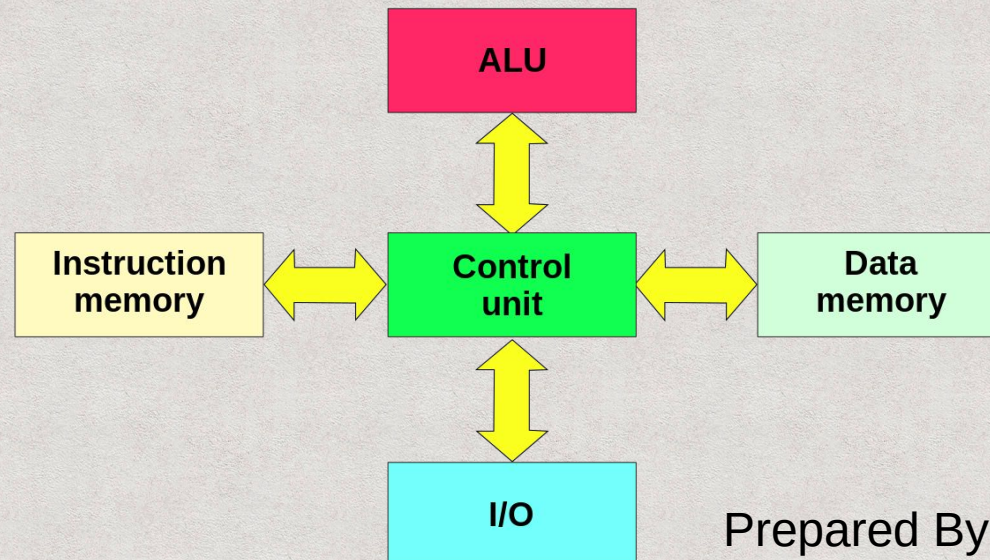
1.9 Anatomy of Digital Computers:
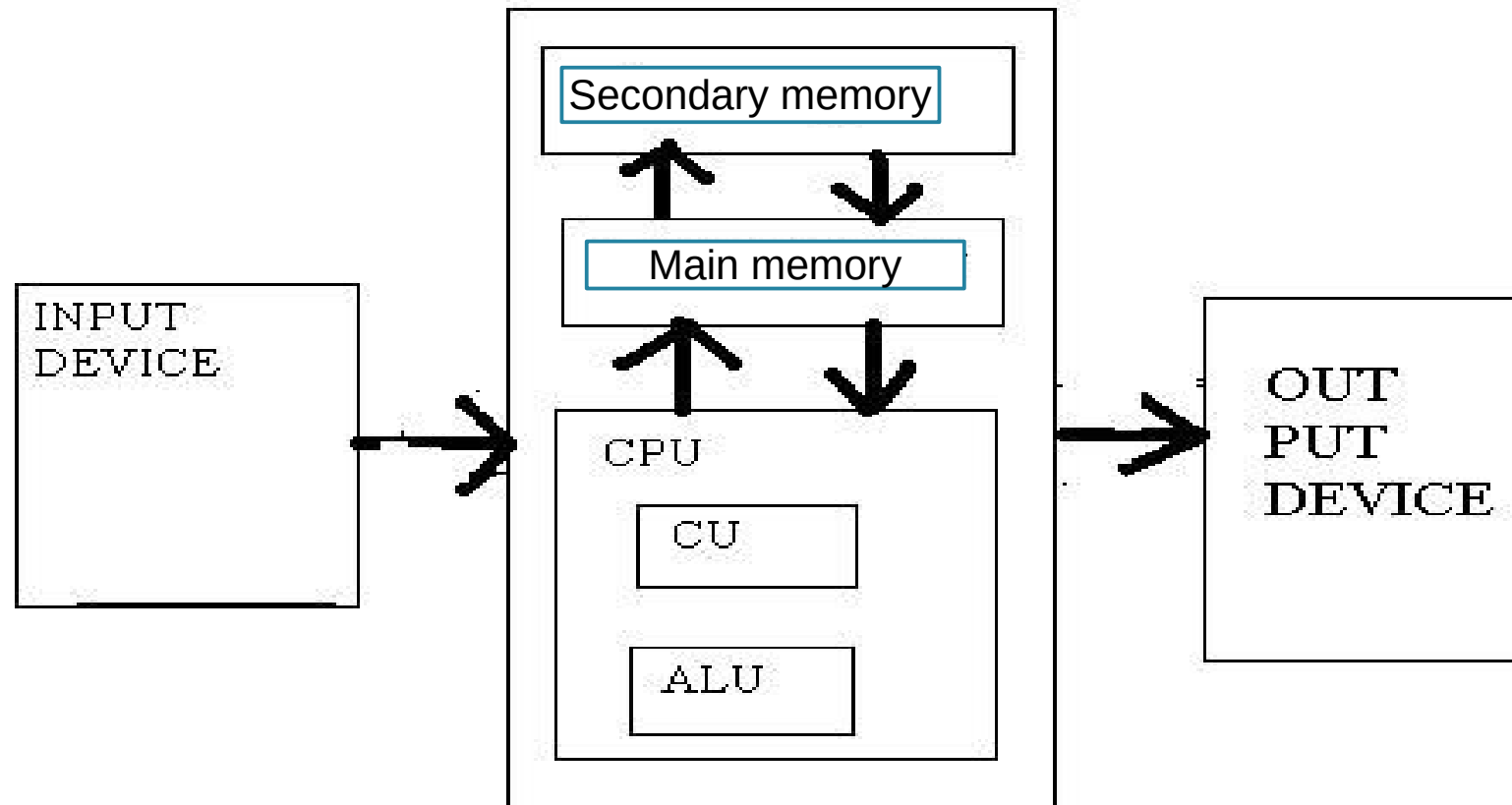
BLOCK DIAGRAM OF A DIGITAL COMPUTER

- A computer contains different hardware components that interact with each other to perform the task.

- Major hardware components in computer systems are described as:

a) Input Unit:

- The input unit provides data to the computer system from the outside.

- So, basically it links the external environment with the computer.

- It takes data from the input devices, converts it into machine language and then loads it into the computer system.

- Keyboard, mouse etc. are the most commonly used input devices.

b) Output Unit:

- The output unit provides the results of computer process to the users i.e it links the computer with the external environment.

- Most of the output data is the form of audio or video.

- Monitors, printers, speakers, etc. are the most commonly used output devices.

c) Primary Memory:

- A memory that is directly accessible by the processing unit is called primary memory.

- We can store and retrieve data much faster with primary memory compared to secondary memory.

- Normally primary memory is volatile in nature & is more expensive than secondary memory.

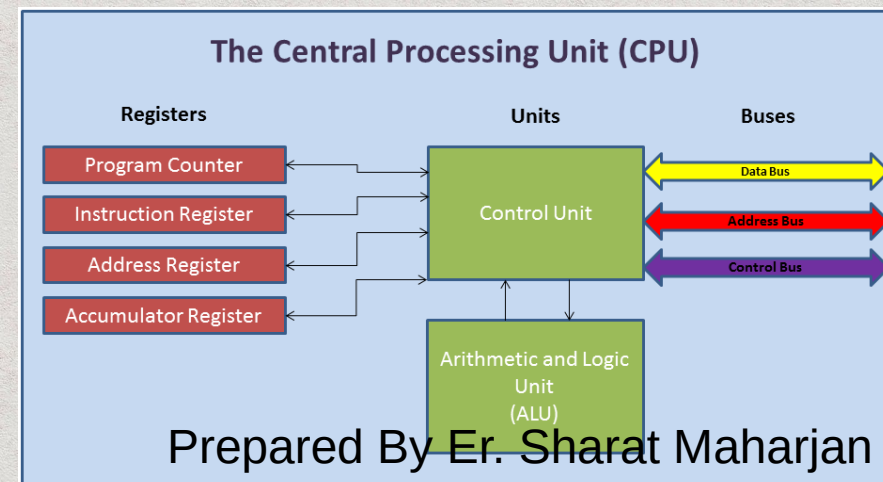- Examples: Random Access Memory(RAM), Read Only Memory(ROM) & Cache Memory.

d) Secondary Memory:

- A memory that is not directly accessible by the processing unit is called secondary memory.

- The operating speed is slower than that of the primary memory.

- Huge volume of data are stored here on permanent basis & transferred to the primary memory when required.

e) Central Processing Unit:

- The part of the computer that executes program instructions is known as processor or central processing unit(CPU).

- It consists of three components:

  1) Arithmetic & Logic Unit(ALU)

  2) Control Unit(CU)

  3) Registers

The Central Processing Unit (CPU)

Registers	Units	Buses
Program Counter	Control Unit	Data Bus
Instruction Register		Address Bus
Address Register		Control Bus
Accumulator Register	Arithmetic and Logic Unit (ALU)	

Prepared By Er. Sharat Maharjan

1) Arithmetic & Logic Unit(ALU):

- It is the unit of microprocessor where various computing functions are performed on the data.

- It performs arithmetic operations such as addition, subtraction & logical operations such as OR,AND etc.

- It is also known as the brain of the computer system.

2) Control Unit(CU):

- This unit controls all the other units of the computer system and so is known as its central nervous system.

- It transfers data throughout the computer as required including from storage unit to central processing unit and vice versa.

- The control unit also dictates how the memory, input output devices, arithmetic logic unit etc. should behave.

3) Registers:

- They are the smallest and fastest additional memory which are used to store & transfer data & instructions that are currently being executed.

- Some of the registers include data register, accumulator register, instruction register,program counter, etc.

- For example, data register is used to store operands (variables) to be operated by the processor & accumulator register is used to store the results produced by the system.

1.10 System Buses:

- A bus is a set of wires used for moving data, instruction, and control signals from one component of a computer system to another component.

- Each component of the computer is connected to these buses.

- We can divide buses into three categories:

    a) Address Bus

    b) Data Bus

    c) Control Bus

- A system bus is a single computer bus that connects major components of a computer system, combining the functions of a data bus, an address bus, and a control bus to determine its operation.
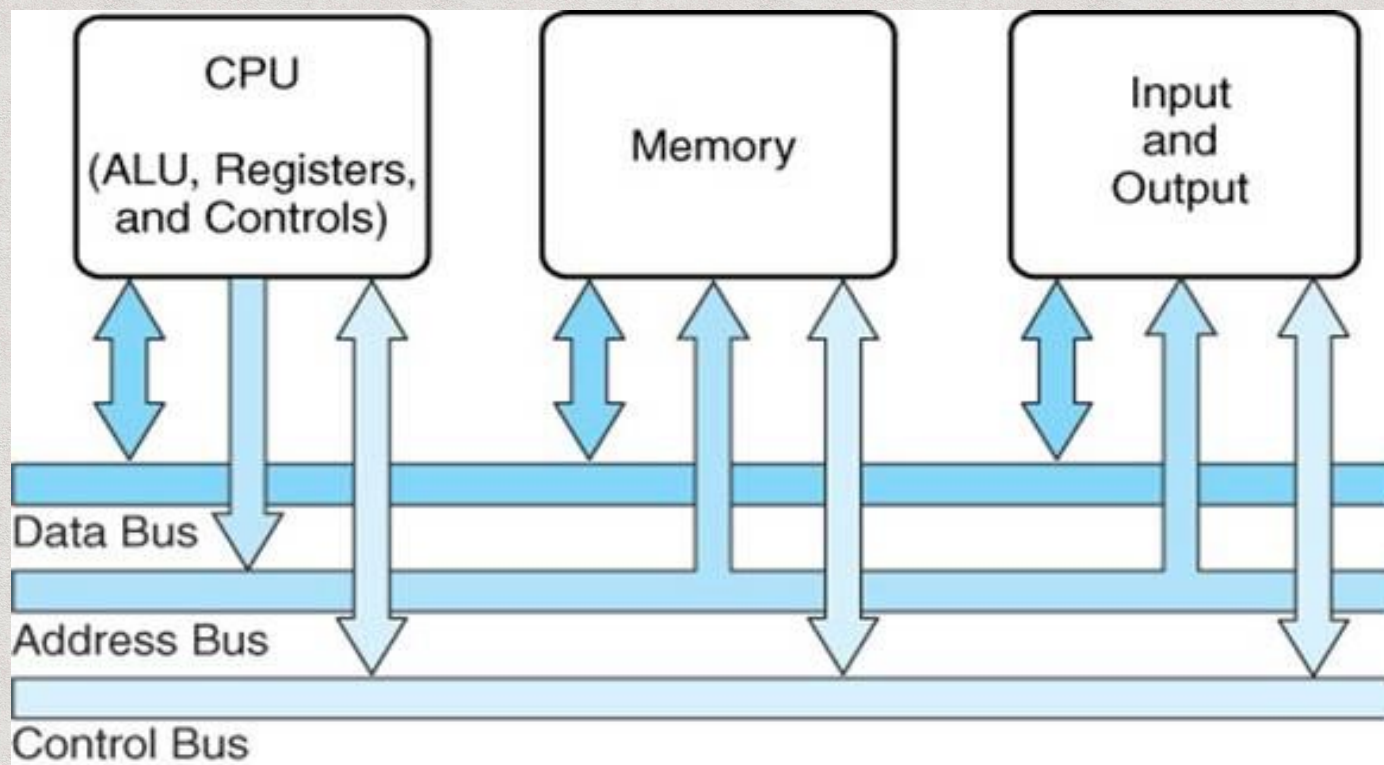
Fig: System Bus

a) Address Bus:

- It is used to specify the address of the memory location to be accessed.

- CPU reads and writes data from and to memory locations by specifying the memory address.

- Address bus is unidirectional i.e; it carries memory location in only one direction, from CPU to memory.

b) Data Bus:

- Actual data is transferred via data bus.

- CPU sends an address to memory; the memory will send data via data bus in return to the CPU.

- In case of write operation, CPU sends an address via address bus & data via data bus.

- It is bidirectional bus i.e; the data can be transferred from CPU to main memory & vice versa.

c) Control Bus:

- It is the path for sending the control signals like read, write, fetch, etc generated by Control Unit..

- Control bus is used to tell what to do with the selected memory location.

- It is bidirectional bus i.e; it transmits command signals from the CPU and response signals from the hardware.
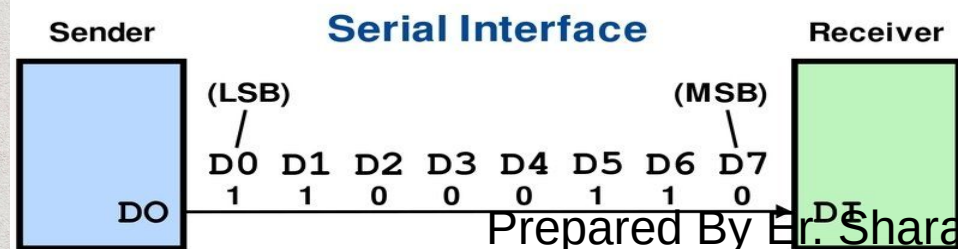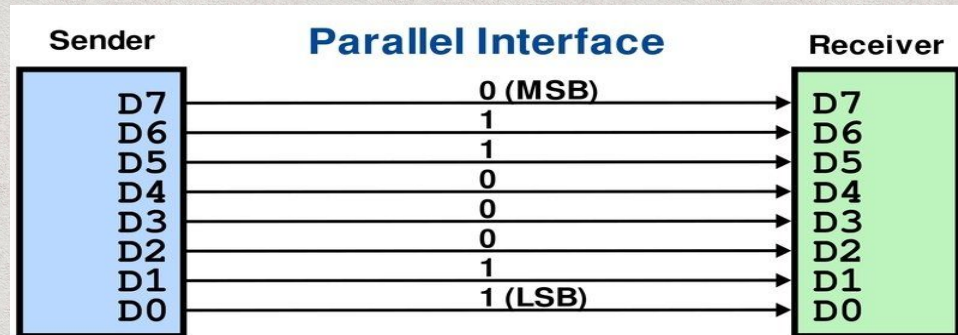
1.11 Interfaces:

- An interface is a shared boundary across which two or more separate components of a computer system exchange information.

- The exchange can be between software, computer hardware, peripheral devices, humans, and combinations of these.

- Interfaces can be divided into two categories:

    a) Parallel Interface
    b) Serial Interface

a) Parallel Interface:

- They have several electrical connections and are capable of carrying many bits simultaneously.

- Data can be sent much faster.

- Many connections pins are required.

- Printers, Hard Drives, CD drives use parallel ports.

b) Serial Interface:

- They are only capable of sending one bit at a time.

- Data are sent slower compare to parallel interface.

- They use fewer pins.

- Keyboard, mouse, security cameras use serial ports.

Comparison between Parallel and Serial Interfaces:

- Serial Interface is slow in comparison of Parallel Interface.

- Serial Interface is used for long-distance while Parallel Interface is used for short distance.

- Serial Interface is cost-efficient than Parallel Interface.

- The circuit used in Serial Transmission is simple than in Parallel Interface.